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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/035,603	12/28/2001	Robert M. English	112056-0036	3815
24267	7590	09/06/2005	EXAMINER	
CESARI AND MCKENNA, LLP 88 BLACK FALCON AVENUE BOSTON, MA 02210			KERVEROS, JAMES C	
			ART UNIT	PAPER NUMBER
			2133	

DATE MAILED: 09/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/035,603

Applicant(s)

ENGLISH ET AL.

Examiner

JAMES C. KERVEROS

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 June 2005.
2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-42, 45-58 and 60-70 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☒ Claim(s) 11-16, 19-23, 28, 29 and 60-70 is/are allowed.
6) ☒ Claim(s) 1-10, 17, 18, 24-27, 30-42 and 45-58 is/are rejected.
7) ☒ Claim(s) 1-9, 26 and 27 is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on 28 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 6/3/2005
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 6/24/2005 has been entered.

This is a Non-Final Office Action in response to Amendment and RCE filed on 6/24/2005, responsive to the Final Office Action mailed 1/27/2005.

Status of Claims

Claims 1-58 were previously examined. Claims 43, 44 and 59 are cancelled.
Claims 60-70 are new.

Claims 1-42, 45-58 and 60-70 are pending and presently under examination.

Claims 11-16, 19-23, 28, 29 and 60-70 are allowed.

Claims 1-10, 17, 18, 24-27, 30-42, 45-58 are rejected.

Claim Objections

Claims 1-9 and 26-27 are objected to because of the following informalities:

Independent Claims 1 and 26 recite: "adapted to ..." It has been held that the recitation that an element is "adapted to" perform a function is not a positive limitation

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but only requires the ability to so perform. It does not constitute a limitation in any patentable sense. *In re Hutchison*, 69 USPQ 138. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-10, 17, 18, 24-27, 30-42, 45-58 are rejected under 35 U.S.C. 102(b) as being anticipated by Blaum et al. (U.S. Patent No. 5,579,475).

Regarding independent Claims 1, 26, Blaum discloses a system for encoding and rebuilding the data contents of up to two unavailable DASDs in a DASD array of simple non-recursive diagonal and row parity, using a combination of multiple first parity groups and a single secondary parity group, Figure 1, the system comprising:

A storage array, such as M DASDs array defined as an (M-1)*M block array, having a plurality of concatenated sub-arrays, a group of DASDs (GROUP 1 or 2), each sub-array (GROUP 1) including a set of data storage devices (DASD0 DASD1 DASD2 DASD3 DASD4) and a first parity storage device (PARITY DASD1 and PARITY DASD2, parity group), the M DASDs array further including a global secondary storage device, such as a parity striping buffer (PSB) 7 associated with the M DASDs array and storing secondary parity values for the single secondary parity group, the secondary

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parity values computed across the concatenation of the sub-arrays (DASD0 DASD1 DASD2 DASD3 DASD4). PSB 7 performs striping (serial/parallel conversion of data) and parity generation and checking associated with the M DASDs array. A new diagonal and row parities are computed taking the old data, old parity, and new data into account, and then the new data block and new parities are recorded in place on the counterpart array DASDs.

Regarding Claims 2, 3, Blaum discloses generating a $(M-1)*M$ block array from an $(M-1)*(M-2)$ data block array using non-recursive simple parity coding over the data array independently in row major and diagonal major order, M being a prime number, and the diagonals taken with a toroidal topology. The parity value of each array diagonal is of the same mode (odd or even) as that of a reference major diagonal, and the parity mode of each row are even. Simple parity coding means the XOR'ing of the data blocks in the diagonal or row traverse, (see Summary of the Invention).

Regarding Claims 4-6, Blaum discloses encoding the diagonal parity for the single diagonal parity group across the concatenated sub-arrays (GROUP 1). Encoding or rebuilding) in Blaum I involves repeatedly alternating a diagonal parity assignment with a row parity assignment in zig/zag fashion so as to cover the entire $(M-1)*M$ data array according to a deterministic process. Each of the M diagonal parity assignments involves XORing M-2 data elements and placing the result in a first parity position. This is followed by XORing of the M-1 data elements of the row intersecting the first parity position and placing the result in a second parity position in that row (see, Col. 2, lines 58-67). Also, see Encoding (Block 22) described in Figure 2, (Col. 7, lines 32-47).

Regarding Claims 7,8, Blaum discloses wherein each sub-array is (GROUP 1 or 2) organized as a concentrated and as a distributed parity disk array, Figure 1. In claim 7, Blaum cites, "ascertaining a parity mode of the data blocks distributed over a major diagonal of the logical array, the data blocks in the logical array also being ordered as a plurality of diagonals".

Regarding Claim 9, Blaum discloses direct access storage devices (DASDs) corresponding to magnetic disk devices.

Regarding Claim 27, Blaum discloses data storage devices (DASD0 DASD1 DASD2 DASD3 DASD4) store packets of DATA and wherein the failure recovery is parity comprising diagonal and row parities.

Regarding independent Claims 10, 24, 25, 30, 45, 58, Blaum discloses a method and apparatus for encoding and rebuilding the data contents of up to two unavailable DASDS in a DASD array of simple non-recursive diagonal and row parity, using a combination of multiple first parity groups and a single secondary parity group, Figure 1, the method, comprising:

Organizing a storage array, such as M DASDs array defined as an $(M-1)*M$ block array, having a plurality of concatenated sub-arrays, a group of DASDs (GROUP 1 or 2), each sub-array (GROUP 1) including a set of data storage devices (DASD0 DASD1 DASD2 DASD3 DASD4) and a first parity storage device (PARITY DASD1 and PARITY DASD2, parity group), the M DASDs array further including a global secondary storage device, such as a parity striping buffer (PSB) 7 associated with the

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M DASDs array and storing secondary parity values for the single secondary parity group, the secondary parity values computed across the concatenation of the sub-arrays (DASD0 DASD1 DASD2 DASD3 DASD4). PSB 7 performs striping (serial/parallel conversion of data) and parity generation and checking associated with the M DASDs array. A new diagonal and row parities are computed taking the old data, old parity, and new data into account, and then the new data block and new parities are recorded in place on the counterpart array DASDs.

Computing (encoding) the diagonal parity for the single diagonal parity group across the concatenated sub-arrays (GROUP 1). Encoding or rebuilding in Blaum I involves repeatedly alternating a diagonal parity assignment with a row parity assignment in zig/zag fashion so as to cover the entire $(M-1)*M$ data array according to a deterministic process. Each of the M diagonal parity assignments involves XORing M-2 data elements and placing the result in a first parity position. This is followed by XORing of the M-1 data elements of the row intersecting the first parity position and placing the result in a second parity position in that row (see, Col. 2, lines 58-67). Also, see Encoding (Block 22) described in Figure 2, (Col. 7, lines 32-47).

Correcting storage device failure within the array using a method for coding and rebuilding $(M-1)*M$ symbol data array onto an M synchronous DASD array when up to two DASDs fail, M being a prime number. Pairs of simple parities are recursively coded in respective diagonal major and intersecting row major order data array directions covering a topological torus. Rebuilding data upon unavailability of no more

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than two DASDs requires a simple recursive operation similar to the encoding step, and involving exclusive-OR operations only (Col.2, lines 48-57).

Regarding Claims 17, 18, 41, 42, Blaum discloses wherein each sub-array is (GROUP 1 or 2) organized as a concentrated and as a distributed parity disk array, see Figure 1. In claim 7, Blaum cites, "ascertaining a parity mode of the data blocks distributed over a major diagonal of the logical array, the data blocks in the logical array also being ordered as a plurality of diagonals".

Regarding Claims 31, 32, 46, 47, 56, 57, Blaum discloses storing all row and diagonal parity data on PSB 7, where two parity blocks stored on the M DASD array. A new diagonal and row parities are computed taking the old data, old parity, and new data into account, and then the new data block and new parities are recorded in place on the counterpart array DASDs.

Regarding Claims 33, 34, 48, 49, Blaum discloses encoding the diagonal parity for the single diagonal parity group across the concatenated sub-arrays (GROUP 1). Encoding or rebuilding) in Blaum I involves repeatedly alternating a diagonal parity assignment with a row parity assignment in zig/zag fashion so as to cover the entire $(M-1)*M$ data array according to a deterministic process. Each of the M diagonal parity assignments involves XORing M-2 data elements and placing the result in a first parity position. This is followed by XORing of the M-1 data elements of the row intersecting the first parity position and placing the result in a second parity position in that row (see, Col. 2, lines 58-67). Also, see Encoding (Block 22) described in Figure 2, (Col. 7, lines 32-47).

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Regarding Claims 35-40, 50-55, Blaum discloses correcting storage device failure within the array using a method for coding and rebuilding $(M-1)*M$ symbol data array onto an M synchronous DASD array when up to two DASDs fail, M being a prime number. Pairs of simple parities are recursively coded in respective diagonal major and intersecting row major order data array directions covering a topological torus. Rebuilding data upon unavailability of no more than two DASDs requires a simple recursive operation similar to the encoding step, and involving exclusive-OR operations only (Col.2, lines 48-57). Also, see Figure 5, which shows a high level control flow for parity coding and rebuilding information in the event that up to two DASDs become concurrently unavailable.

Allowable Subject Matter

Claims 11-16, 19-23, 28, 29 and 60-70 are allowed.

The following is an examiner's statement of reasons for allowance:

The prior arts of record taken alone or in combination fail to teach, anticipate, suggest or render obvious the claimed invention, including inter alia, determining whether the storage device failure is to a single storage device in a sub-array; if the storage device failure is to a single storage device in the sub-array, reconstructing the failed storage device using local row parity associated with the sub-array; and if the storage device failure is not to a single storage device in the sub-array, reconstructing the failed global diagonal parity storage device using all data and row parity storage devices of all sub-arrays of the array.

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Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Response to Arguments

Applicant's arguments with respect to claims 1-42, 45-58 and 60-70, filed with the Amendment and RCE on 6/24/2005 have, been considered but are moot in view of the new grounds of rejection, under 35 U.S.C. 102(b) as being anticipated by Blaum et al. (U.S. Patent No. 5,579,475).

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Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JAMES C. KERVEROS whose telephone number is (571) 272-3824. The examiner can normally be reached on 9:00 AM TO 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decady can be reached on (571) 272-3819. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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Office Action: Non-Final Rejection

JAMES C KERVEROS
Examiner
Art Unit 2133

By: 